UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Principal Facts for 1980 Gravity Stations in the Wallace 1^{o} X 2^{o} Quadrangle, Montana-Idaho

by

Viki Bankey, Mike Brickey, and M. D. Kleinkopf

Open-File Report 82-132

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Introduction

In July and August, 1980, 89 new gravity stations were established in the Wallace 1° X 2° quadrangle in Idaho and Montana (Fig.1). The work was done in support of the Conterminous United States Mineral Appraisal Program (CUSMAP). These data compliment gravity surveys done previously by Wilson (1979), and Brickey and others, (1981).

Data Collection

Gravity observations were made using the LaCoste-Romberg gravity meter, G-24. The observations were referenced to the Department of Defense (DOD) base at Wallace, Idaho, which is on the datum of the International Gravity Standardization Net (IGSN), 1971, established by the Defense Mapping Agency Aerospace Center (1974). Secondary U.S. Geological Survey bases were established at the following locations: Plains, Superior, and Thompson Falls, Mt. Complete base descriptions are included at the end of this report (Appendices A-D).

Elevation Control

Most of the elevations were obtained from benchmarks or spot elevations found on 1:24,000 and 1:62,500 scale USGS topographic maps. Elevations for stations DK4, DK8, DK13, and DK19 were estimated from 80-ft contour intervals at known positions on 1:62,500 scale maps. For elevations based on benchmarks, the uncertainty is assumed to be 0.5 ft; for spot elevations and section corners with map elevations, the uncertainty is assumed to be one-third of the contour interval. At a contour interval of 40 ft the uncertainty is 13.3 ft (4.1m). For the four estimated stations, the elevation uncertainty is one half of the contour interval, or 40 ft (12.2m). The elevation uncertainties translate to uncertainties in Bouguer values, at a density

of 2.67 g/cm^3, as .2 mgal/m. The maximum uncertainty for the four stations estimated from 80 ft contours is 2.3 mgal. For spot elevations, the uncertainty is .76 mgal. For benchmarks, the uncertainty is .28 mgal.

Data Reduction

Computer programs existing on the USGS Honeywell Multics computer system were used to obtain principal facts and terrain-corrected gravity values. A program written by D. Dansereau and R. Wahl (USGS, unpublished program, 1979) was used to reduce gravity meter readings to observed gravity values by calculating and correcting for earth-tide and linear meter drift. The theoretical gravity value was calculated using the 1967 formula of the Geodetic Reference System (International Association of Geodesy, 1967).

Complete terrain corrections were computed using a program by R. H. Godson (USGS, unpublished program, 1978), correcting for the terrain from each station out to a radius of 166.7 km from the station using the method of Plouff (1977). These computed terrain corrections are based on mean elevation data digitized on a 15-second grid for corrections from 0 to 5 km; 1-minute terrain data for corrections from 5 to 21 km; and 3-minute terrain data for corrections from 21 to 166.7 km. An assumed density of 2.67 g/cm^3 was used to calculate terrain corrections. Godson's program also calculates earth curvature corrections and complete (terrain-corrected) Bouguer anomaly values. Two complete Bouguer anomaly values per station were obtained using average rock densities of 2.67 g/cm^3 and 2.45 g/cm^3. The corrections and anomaly values are listed in Appendix E.

References

Brickey, M. R., Bankey, V., and Kleinkopf, M. D., 1981, Principal facts for gravity stations in part of the Wallace 1^{o} X 2^{o} Quadrangle, Idaho and Montana: U.S. Geological Survey Open-File Report 81-178.

Defense Mapping Agency Aerospace Center, 1974, World Relative Gravity Reference Network, North America, Part 2: DMAAC Reference Publication 25, with supplement updating gravity values to the International Gravity Standardization Net 1971, 1635 p.

International Association of Geodesy, 1967, Geodetic Reference System, 1967, International Association of Geodesy Special Publication 3, 74 p.

Plouff, D., 1977, Preliminary documentation for a FORTRAN program to compute gravity terrain corrections based on topography digitized on a geographic grid: U.S. Geological Survey Open-File Report 77-535.

Wilson, D. M., 1979, Principal facts for gravity stations in the Wallace 2^{o} Quadrangle, Montana and Idaho: U.S. Geological Survey Open-File Report 79-1309.

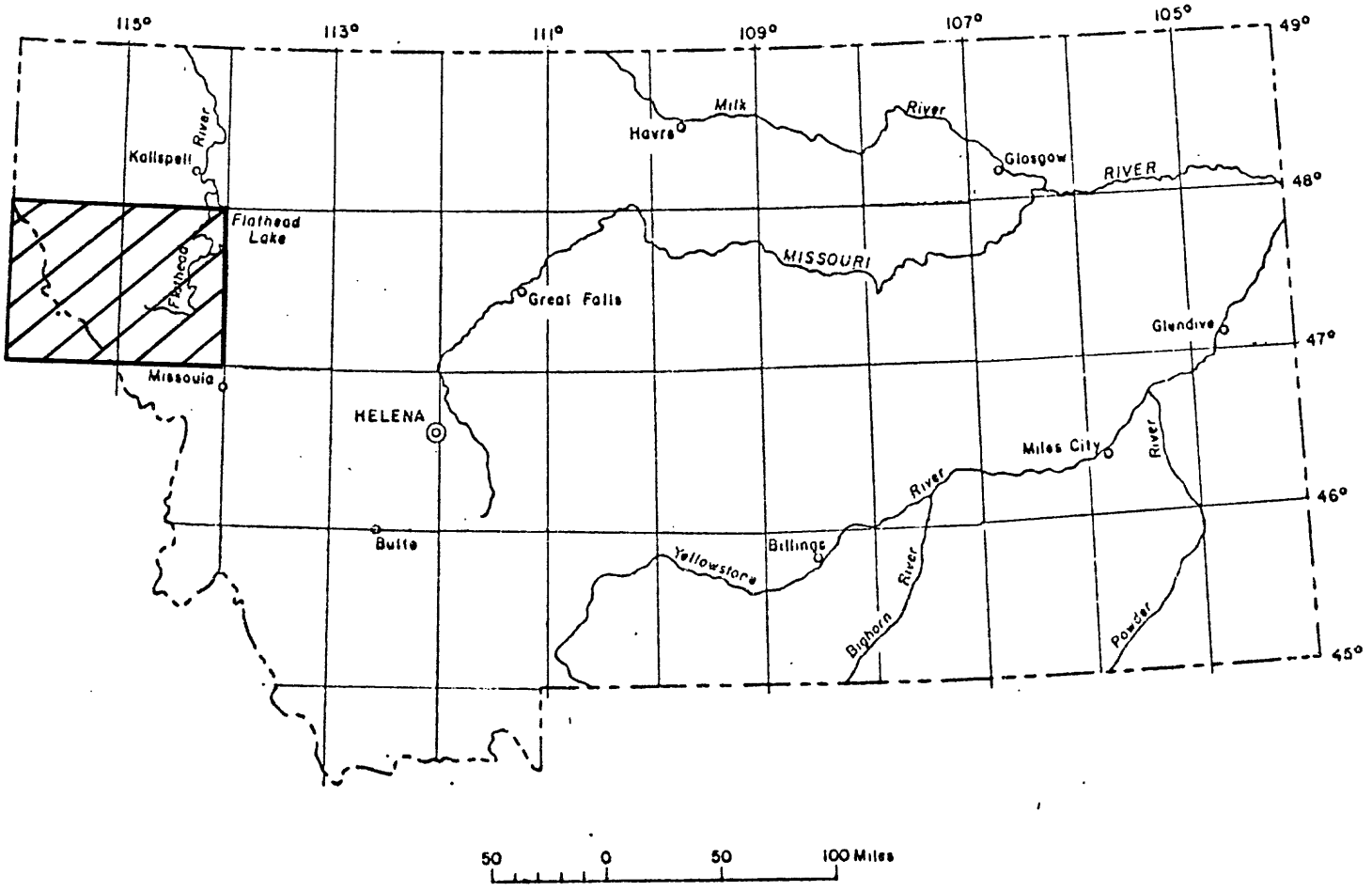


Figure 1: Index map, Wallace 1° x 2° Quadrangle, Montana - Idaho

APPENDIX A

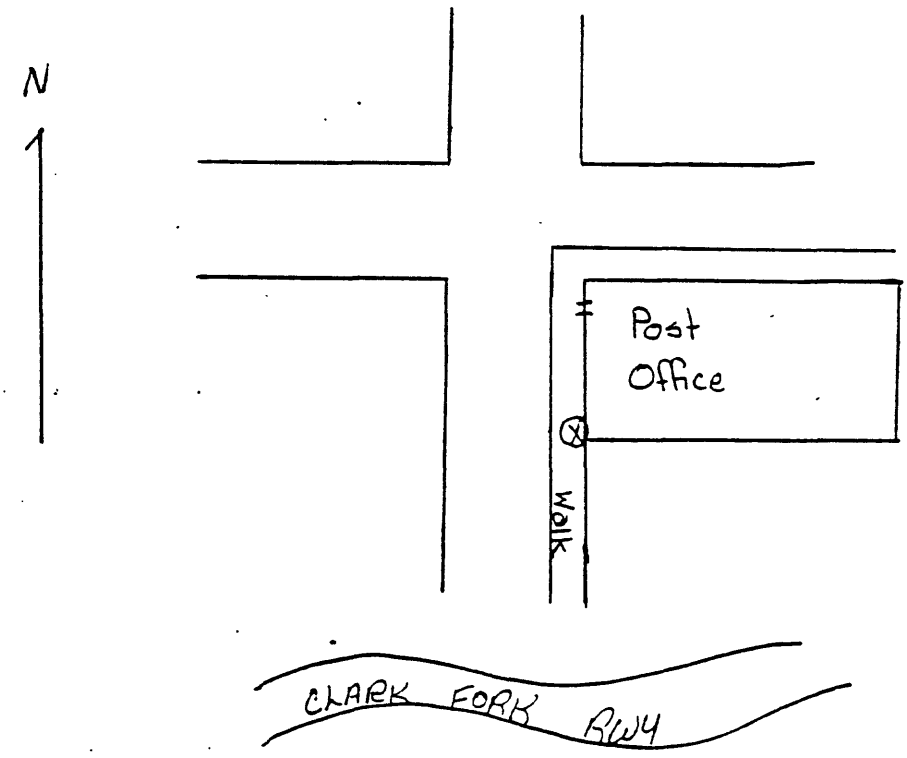
U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY	STATION DESIGNATION	OBSERVED GRAVITY
Montana	Superior Post Office	980498.89 mgals
NEAREST TOWN	LONGITUDE	LATITUDE
Superior	114° 53.00'	47° 11.55'
ELEVATION	TOPOGRAPHIC MAP(S)	
835.3 m (2740')	Wallace 1/250,000	

DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
7/1/75	Kleinkopf/Wilson	G-159	Missoula Airport	980429.45 mgals

DESCRIPTION/SKETCH

Base is on sidewalk 8' north of southwest corner of the P.O. building.



APPENDIX B

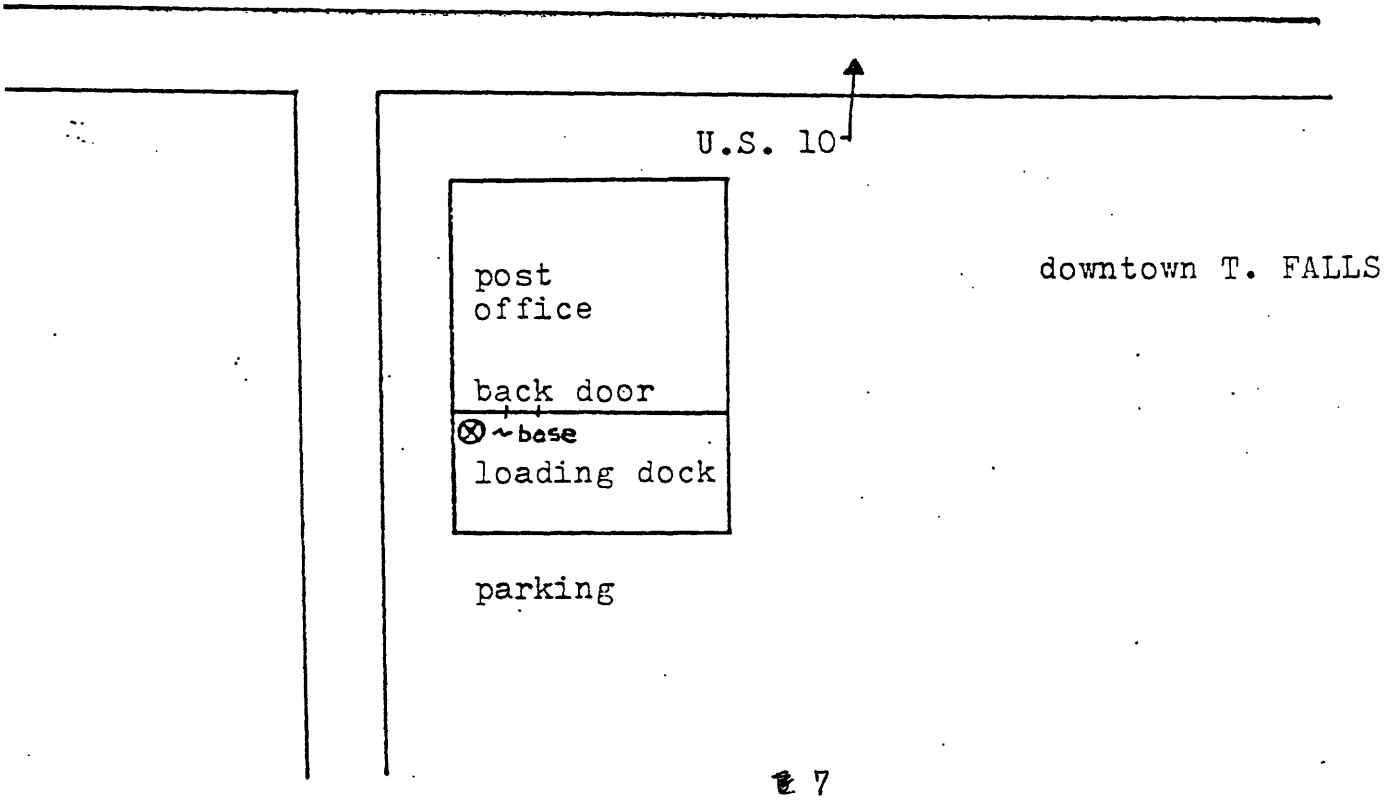
U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY	STATION DESIGNATION	OBSERVED GRAVITY
Montana	Thompson Falls Post Office	980556.65
NEAREST TOWN	LONGITUDE	LATITUDE
Thompson Falls	115° 21.26'	47° 35.73
ELEVATION	TOPOGRAPHIC MAP(S)	
734.7 m (2410')	Thompson Falls 15'; Wallace 2°	

DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
8/21/78	Brickey	G-235	Missoula DOD	980429.45

DESCRIPTION/SKETCH

Base is at southwest corner of the new post office in Thompson Falls, Montana. Base is on cement loading dock, 6 feet from the back door.

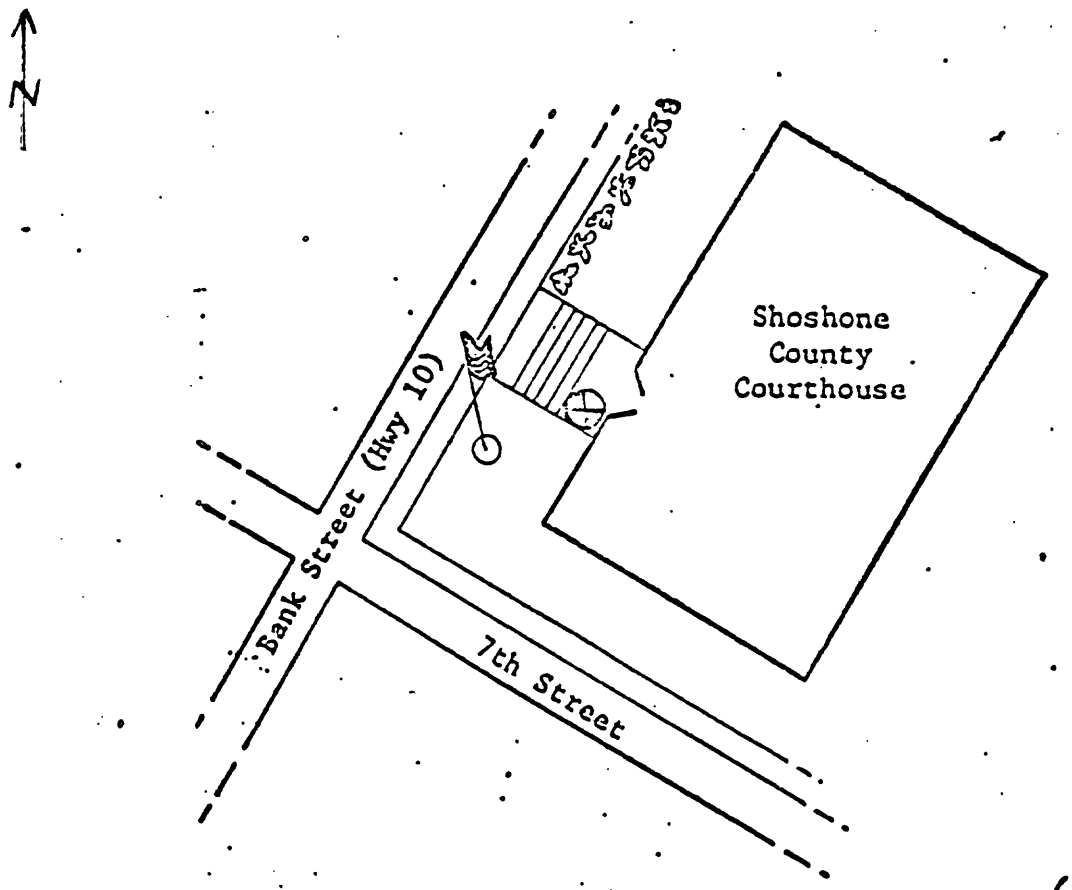


GRAVITY BASE STATION

LATITUDE	STATION DESIGNATION
47° 28.28'N (1)	WALLACE
LONGITUDE 115° 55.26'W (1)	
ELEVATION 835.76 METERS (1)	**COUNTRY/STATE** USA/Idaho
REFERENCE CODE NUMBERS	**ADOPTED GRAVITY VALUE**
ACIC 4006-1	g= 980 557.96 mgals
IGB 15675B	
	ESTIMATED ACCURACY ± 0.1 mgals
	DATE MONTH/YEAR 10/70

DESCRIPTION AND/OR SKETCH

The station is in Wallace, at the Shoshone Courthouse on the top main steps, one foot west of the main entranceway, one foot below USC & GS BM, on the concrete step. (1)



(1)

REFERENCE SOURCE

(1) 03405

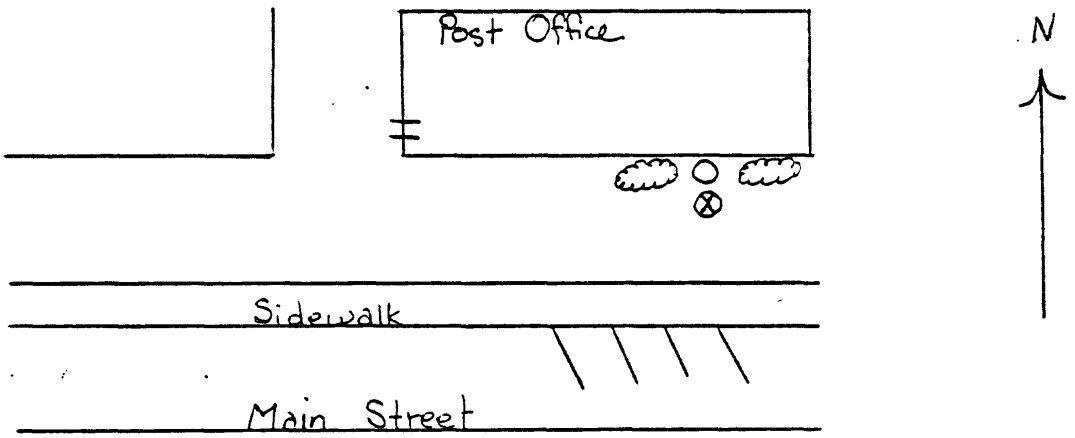
U.S. GEOLOGICAL SURVEY
GRAVITY BASE STATION

STATE/COUNTRY	STATION DESIGNATION	OBSERVED GRAVITY
Montana	Plains Post Office	980554.98 mgals
NEAREST TOWN	LONGITUDE	LATITUDE
Plains	114° 52.95'	47° 26.34'
ELEVATION	TOPOGRAPHIC MAP(S)	
	Plains 1/62,000	

DATE	OBSERVER	METER	REFERENCE STATION	REFERENCE VALUE
6/30/75	Kleinkopf/Wilson	G-159	Cabinet Ranger Station	980060.08 mgals

DESCRIPTION/SKETCH

Base is at Post Office located on north side of Main Street and at base of flagpole.



Appendix E: Principal Facts of Gravity Data

Explanation of headings

Identification	
proj	Project name.
sta id	Gravity identification.
Location	
latitude	North latitude in degrees minutes and hundredths of minutes.
longitude	West longitude in degrees, minutes, and hundredths of minutes.
ele	Station elevation in feet.
st	State where station is located.
Gravity	
observed	Observed gravity in milligals.
theoretical	Theoretical gravity.
Corrections	
terrain	Terrain correction out to 166.7km in milligals.
Bouguer	Elevation correction in milligals.
curv	Curvature correction in milligals.
special	Not used.
Anomalies	
free-air	Free-air anomaly in milligals.
complete-Bouguer	Complete Bouguer anomaly in milligals for designated densities.
spec fields	Not used.

BOUGUER GRAVITY DATA

Wallace Cusmap Gravity Data
1980
Meter Id: g-24 Date: 12/03/80

STATION IDENTIFICATION prof	sta-id	LOCATIONS LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
	w11000	47	2.20	-114	44.04	3115.0	mt	980452.49	980803.26	2.54	-106.24	-1.07	0.00	-57.89	-162.67	-154.04	
	w11002	47	5.32	-114	34.30	7349.0	mt	980191.61	980807.95	26.14	-250.65	-1.51	0.00	74.40	-151.62	-133.00	
	w11003	47	6.81	-114	41.96	3640.0	mt	980432.05	980810.20	8.04	-124.15	-1.19	0.00	-35.93	-153.23	-143.57	
	w11004	47	10.96	-114	40.14	6132.0	mt	980300.37	980816.45	6.16	-209.14	-1.50	0.00	60.33	-144.14	-127.31	
	w11005	47	10.28	-114	38.94	6691.0	mt	980258.02	980815.42	13.46	-228.21	-1.52	0.00	71.53	-144.73	-126.91	
	w11006	47	4.27	-115	5.59	5392.0	mt	980326.90	980806.38	6.64	-183.91	-1.45	0.00	27.40	-151.32	-136.59	
	w11007	47	3.86	-115	13.09	4693.0	mt	980367.71	980805.76	6.20	-160.07	-1.37	0.00	3.14	-152.10	-139.30	
	w11008	47	39.66	-115	43.30	4766.0	mt	980444.29	980859.90	6.87	-162.55	-1.38	0.00	32.43	-124.63	-111.69	
	w11009	47	39.31	-115	44.52	5526.0	mt	980397.26	980859.07	7.08	-188.48	-1.46	0.00	57.64	-125.22	-110.15	
	w11010	47	43.59	-115	38.62	5798.0	mt	980372.51	980865.20	18.05	-197.75	-1.48	0.00	52.32	-128.86	-113.94	
	w11011	47	42.69	-115	41.16	5312.0	mt	980413.98	980864.15	9.43	-181.18	-1.44	0.00	49.18	-124.01	-109.74	
	w11012	47	22.33	-114	51.47	6837.0	mt	980265.32	980833.55	31.00	-233.19	-1.52	0.00	74.42	-129.29	-112.51	
	w11014	47	37.76	-115	38.54	6395.0	mt	980325.01	980856.74	15.94	-218.12	-1.51	0.00	69.38	-134.31	-117.53	
	w11015	47	58.49	-115	45.58	2423.0	mt	980605.09	980687.88	3.67	-82.64	-0.89	0.00	-54.97	-134.83	-128.25	
	w11016	47	56.96	-115	53.55	4050.0	mt	980512.21	980685.58	5.58	-138.13	-1.27	0.00	7.38	-126.44	-115.42	
	w11017	47	57.26	-115	55.45	5411.0	mt	980427.79	980886.03	10.62	-184.55	-1.45	0.00	50.41	-124.98	-110.53	
	w11018	47	55.38	-115	54.82	4642.0	mt	980464.72	980883.21	7.62	-165.15	-1.39	0.00	36.69	-122.23	-109.13	
	w11019	47	55.05	-115	52.42	5190.0	mt	980441.84	980882.71	6.49	-177.02	-1.43	0.00	47.01	-124.94	-110.78	
	w11020	47	55.40	-115	50.91	5022.0	mt	980450.83	980883.24	6.51	-171.29	-1.41	0.00	39.69	-126.50	-112.81	
	w11021	47	54.32	-115	56.27	5343.0	mt	980434.81	980881.62	5.87	-182.23	-1.45	0.00	55.46	-122.36	-107.70	
	w11022	47	53.69	-115	57.27	6065.0	mt	980386.98	980880.67	10.65	-206.86	-1.50	0.00	76.41	-121.29	-105.00	
	w11023	47	54.61	-115	57.86	5879.0	mt	980401.73	980882.05	10.63	-200.52	-1.49	0.00	72.31	-119.07	-103.30	
	w11024	47	55.26	-115	58.98	5658.0	mt	980416.49	980883.03	8.72	-192.98	-1.47	0.00	65.32	-120.41	-105.11	
	w11025	47	55.47	-115	56.33	3566.0	mt	980536.02	980883.34	14.32	-121.63	-1.17	0.00	-12.06	-120.54	-111.60	
	w11026	47	56.86	-115	57.08	2914.0	mt	980575.93	980885.43	12.11	-99.39	-1.02	0.00	-35.53	-123.83	-116.55	
	w11027	47	57.97	-115	58.71	2621.0	mt	980595.13	980887.10	11.68	-89.39	-0.94	0.00	-45.53	-124.19	-117.71	
	w11028	47	59.65	-115	59.32	2491.0	mt	980605.97	980889.62	11.65	-84.96	-0.91	0.00	-49.44	-123.66	-117.54	
	w11029	47	54.16	-115	54.60	4798.0	mt	980465.77	980881.38	8.98	-163.65	-1.39	0.00	35.44	-120.61	-107.75	
	w11030	47	53.70	-115	55.15	4125.0	mt	980504.45	980880.69	11.68	-140.69	-1.28	0.00	11.56	-118.73	-107.99	
	w11031	47	53.29	-115	53.07	3225.0	mt	980553.96	980880.07	9.88	-110.00	-1.10	0.00	-22.90	-124.12	-115.78	
	w11032	47	52.15	-115	54.50	3823.0	mt	980518.94	980878.36	11.05	-130.39	-1.23	0.00	-0.01	-120.58	-110.64	
	w11033	47	51.44	-115	53.66	3990.0	mt	980507.97	980877.30	10.45	-136.09	-1.26	0.00	5.78	-121.11	-110.65	
	w11034	47	51.71	-115	51.90	5079.0	mt	980444.32	980877.70	6.81	-173.23	-1.42	0.00	44.07	-123.77	-109.94	
	w11035	47	50.36	-115	52.04	4803.0	mt	980461.04	980875.67	4.46	-163.82	-1.39	0.00	36.88	-123.86	-110.61	
	w11036	47	53.42	-115	47.40	2499.0	mt	980590.73	980880.27	14.34	-85.23	-0.91	0.00	-54.57	-126.37	-120.46	
	w11037	47	48.70	-115	45.74	4048.0	mt	980501.45	980873.18	4.95	-138.07	-1.27	0.00	8.84	-125.55	-114.47	
	w11038	47	49.70	-115	46.20	5351.0	mt	980415.17	980874.68	16.71	-182.51	-1.45	0.00	43.50	-123.74	-109.96	
	w11039	47	48.55	-115	50.86	5216.0	mt	980430.17	980872.95	7.32	-177.90	-1.43	0.00	47.55	-124.47	-110.30	
	w11040	47	46.97	-115	51.38	4780.0	mt	980456.51	980870.58	4.75	-163.03	-1.38	0.00	35.28	-124.38	-111.23	
	w11041	47	47.60	-115	52.99	5585.0	mt	980395.61	980871.52	16.68	-190.49	-1.47	0.00	49.09	-126.19	-111.75	

Wallace Cusmap Gravity Data
1980
Meter ID: g-24 Date: 12/03/80

STATION IDENTIFICATION proj	sta-id	LOCATION LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
	wl1042	47	48.68	-115	52.56	3503.0	mt	980532.07	980873.15	6.97	-119.48	-1.16	0.00	-11.74	-125.41	-116.04	
	wl1043	47	48.91	-115	54.49	3711.0	mt	980519.70	980873.49	9.26	-126.57	-1.20	0.00	-4.90	-123.42	-113.65	
	wl1044	47	49.41	-115	55.95	4248.0	mt	980492.39	980874.24	7.01	-144.89	-1.30	0.00	17.50	-121.68	-110.21	
	wl1045	47	50.29	-115	55.71	3652.0	mt	980524.29	980875.57	10.32	-124.56	-1.19	0.00	-7.93	-123.37	-113.85	
	wl1046	47	52.17	-115	56.34	5392.0	mt	980427.21	980878.39	7.20	-183.91	-1.45	0.00	55.69	-122.47	-107.79	
	wl1047	47	50.19	-115	57.01	4129.0	mt	980501.95	980875.41	5.12	-140.83	-1.28	0.00	14.71	-122.28	-110.99	
	wl1048	47	51.15	-115	56.39	3773.0	mt	980521.07	980876.86	11.52	-128.69	-1.22	0.00	-1.07	-119.46	-109.70	
	wl1049	47	50.07	-115	58.91	3073.0	mt	980564.18	980875.23	6.02	-104.81	-1.06	0.00	-22.14	-121.99	-113.76	
	wl1050	47	51.21	-115	58.53	3276.0	mt	980553.81	980876.95	6.92	-111.73	-1.11	0.00	-15.14	-121.06	-112.33	
	wl1051	47	47.24	-115	57.10	2767.0	mt	980577.64	980870.98	7.09	-94.37	-0.98	0.00	-33.19	-121.46	-114.18	
	wl1052	47	47.85	-115	58.71	3616.0	mt	980527.44	980871.91	8.47	-123.33	-1.18	0.00	-4.50	-120.55	-110.99	
	wl1053	47	45.42	-115	59.53	3880.0	mt	980510.05	980868.25	3.66	-132.34	-1.24	0.00	6.57	-123.35	-112.64	
	wl1054	47	46.52	-115	59.60	4004.0	mt	980505.19	980869.91	4.84	-136.56	-1.26	0.00	11.71	-121.27	-110.32	
	wl1055	47	36.25	-115	4.16	6919.0	mt	980278.86	980854.48	21.94	-235.99	-1.52	0.00	74.73	-140.84	-123.07	
	wl1056	47	37.98	-115	3.89	5565.0	mt	980378.44	980857.07	10.13	-189.81	-1.47	0.00	44.49	-136.65	-121.73	
	wl1057	47	38.52	-115	2.26	5634.0	mt	980374.70	980857.88	10.67	-192.16	-1.47	0.00	46.43	-136.54	-121.46	
	wl1058	47	39.70	-115	0.90	4445.0	mt	980447.75	980859.66	4.38	-151.61	-1.34	0.00	5.97	-142.59	-130.35	
	wl1059	47	35.93	-115	9.89	6232.0	mt	980305.89	980853.99	29.35	-212.56	-1.51	0.00	37.69	-147.02	-131.80	
	wl1060	47	38.13	-115	16.81	6865.0	mt	980272.08	980857.30	29.40	-234.15	-1.52	0.00	60.05	-146.21	-129.22	
	wl1061	47	41.22	-115	17.41	7188.0	mt	980262.80	980861.95	28.16	-245.16	-1.51	0.00	76.47	-142.05	-124.04	
	wl1062	47	38.87	-115	15.61	6858.0	mt	980260.14	980858.41	25.28	-233.91	-1.52	0.00	66.34	-143.80	-126.49	
	wl1063	47	31.81	-115	28.15	5749.0	mt	980349.05	980847.80	19.14	-196.08	-1.48	0.00	41.66	-136.76	-122.06	
	wl1064	47	27.63	-115	27.50	6011.0	mt	980330.92	980841.52	11.91	-205.02	-1.50	0.00	50.44	-140.17	-124.13	
	wl1065	47	29.02	-115	22.19	5980.0	mt	980329.13	980843.61	14.45	-203.96	-1.49	0.00	47.65	-143.36	-127.62	
	wl1066	47	9.30	-115	14.83	7052.0	mt	980217.33	980813.95	20.54	-240.52	-1.51	0.00	66.23	-155.27	-137.02	
	wl1067	47	9.13	-115	18.88	5739.0	mt	980309.31	980813.69	11.27	-195.74	-1.48	0.00	35.10	-150.85	-135.52	
	wl1068	47	7.28	-115	8.02	7409.0	mt	980196.13	980810.91	22.80	-252.70	-1.50	0.00	81.61	-149.79	-130.73	
	dk01	47	3.98	-114	23.90	3153.0	mt	980459.21	980805.94	2.30	-107.54	-1.08	0.00	-50.28	-156.60	-147.84	
	dk02	47	3.14	-114	23.85	3032.0	mt	980467.65	980804.67	4.20	-103.41	-1.05	0.00	-51.96	-152.22	-143.96	
	dk03	47	1.89	-114	23.22	3003.0	mt	980466.61	980802.80	3.60	-102.42	-1.04	0.00	-53.84	-153.71	-145.48	
	edk04	47	1.85	-114	19.40	3015.0	mt	980459.29	980802.73	3.68	-102.83	-1.05	0.00	-59.97	-159.97	-151.73	
	dk05	47	1.51	-114	17.33	3026.0	mt	980455.34	980802.22	3.48	-103.21	-1.05	0.00	-62.37	-163.15	-154.85	
	dk06	47	1.17	-114	15.05	3038.0	mt	980455.42	980801.71	2.68	-103.62	-1.05	0.00	-60.65	-162.64	-154.24	
	dk07	47	11.76	-114	54.68	2754.0	mt	980496.01	980817.65	5.92	-93.93	-0.98	0.00	-62.70	-151.69	-144.36	
	edk08	47	10.94	-114	51.71	2800.0	mt	980492.18	980816.41	6.10	-95.50	-0.99	0.00	-60.97	-151.36	-143.92	
	dk09	47	12.26	-114	49.04	3345.0	mt	980459.17	980818.40	12.43	-114.43	-1.13	0.00	-43.80	-146.92	-138.43	
	dk10	47	7.36	-114	48.19	3071.0	mt	980466.52	980811.02	3.81	-104.74	-1.06	0.00	-55.77	-157.76	-149.36	
	dk12	47	22.05	-115	15.81	3064.0		980497.44	980833.13	5.15	-104.50	-1.06	0.00	-47.41	-147.82	-139.55	
	dke13	47	22.61	-115	20.84	3050.0		980499.84	980833.97	4.61	-104.03	-1.06	0.00	-47.36	-147.84	-139.56	
	dk14	47	22.03	-115	19.81	3000.0		980498.83	980833.09	6.88	-102.32	-1.04	0.00	-52.21	-148.69	-140.74	

APPENDIX E (cont)

BOUGUER GRAVITY DATA

Wallace Cusmap Gravity Data
1980
Meter ID: g-24 Date: 12/03/80

STATION IDENTIFICATION prof	sta-id	LOCATIONS LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECTAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
	dk15	47	23.22	-115	24.02	3130.0		980496.07	980834.88	2.87	-106.75	-1.08	0.00	-44.53	-149.49	-140.85	
	dk16	47	24.69	-115	30.73	3370.0		980464.41	980837.09	7.46	-114.94	-1.13	0.00	-35.84	-144.45	-135.50	
	dk17	47	25.03	-115	33.54	3538.0		980475.36	980837.61	8.17	-120.67	-1.17	0.00	-29.62	-143.29	-133.92	
	dk18	47	25.13	-115	36.05	3635.0		980470.47	980837.76	6.48	-123.98	-1.19	0.00	-21.54	-140.23	-130.45	
	dke19	47	26.24	-115	39.18	3900.0		980459.95	980839.43	7.08	-133.02	-1.24	0.00	-12.82	-140.00	-129.52	
	dk20	47	33.17	-114	49.88	3470.0		980506.55	980809.84	4.10	-118.35	-1.15	0.00	-17.06	-132.46	-122.95	
	dk21	47	42.45	-115	12.53	3707.0		980483.62	980863.79	12.05	-126.43	-1.20	0.00	-31.66	-147.25	-137.72	
	dk22	47	39.50	-115	34.56	5106.0		980403.04	980859.36	17.68	-174.15	-1.42	0.00	23.67	-134.22	-121.21	